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| 10/695,800 | 10/30/2003 | Daijiro Yumoto | 023971-0333 | 6867 |

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FOLEY AND LARDNER LLP
SUITE 500
3000 K STREET NW
WASHINGTON, DC 20007

| EXAMINER | |
|---|---|
| TIBBITS, PIA FLORENCE | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2838 | |

DATE MAILED: 12/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

AK

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/695,800 | YUMOTO ET AL. | |
| | Examiner | Art Unit | |
| | Pia F. Tibbits | 2838 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,12-14 and 16-18* is/are rejected.

7)☒ Claim(s) *4-11 and 15* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 October 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *10/30/03,7/14/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

### *Priority*

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

### *Drawings*

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the low pass filter must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement-drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the examiner does not accept the changes, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### *Specification*

3. The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

4. Applicant is reminded to use consistent language throughout the disclosure in order to facilitate finding support for the recited limitations, as well as to provide proper antecedence for all claimed limitations. For example:

a) the title of the instant application is "Apparatus and method for estimating (a) charge rate of a secondary cell", while the charge rate is in effect the battery SOC [see e.g. claim 2 reciting "charge rate (SOC)";

b) claim 1 recites "an adaptive digital filtering", while claim 2, dependent upon claim 1, recites "the digital filter calculation", and claim 3, dependent upon claim 1, recites "the adaptive digital filter calculation";

c) the specification at paragraph [0051] describes $G_1(s)$ as a "responsive characteristic of low pass filter", while claim 3 recites $1/G_1(s)$ as a "transfer function".

d) applicant is using the letter "k" to symbolize "internal resistance" [see claims 4, 15], as well as a time point [see claim 16], which is hard to distinguish in the current scanned application format.

***Claim Objections***

5. Claims 2, 3 are objected to because of the following informalities:

Claim 2: "the charge rate is estimated from a relationship between the previously derived open-circuit voltage $V_0$, and the charge rate is estimated from a relationship between the previously proposed open-circuit voltage $V_0$ and the charge rate (SOC)" is not clear since a) two (2) different $V_0$ are recited, i.e., previously derived and previously proposed, and b) the previously proposed open-circuit voltage $V_0$ lacks antecedence.

"the digital filter calculation" lacks antecedence;

Claim 3: "the adaptive digital filter calculation" lacks antecedence. Appropriate correction is required.

Claim 16: "when a current is zeroed as an initial value of the terminal voltage" needs to be rephrased as it does not make sense.

"determining instantaneous current values $I_0(k)$, $I_1(k)$, and $I_3(k)$": what happened to $I_2(k)$?

"P (0) is a sufficiently large value" needs to be defined since there is nothing in the specification, prosecution history, or the prior art to provide any indication as to what range of specific activity is covered by the term "P (0) is sufficiently large value". Additionally, P (0) is not mentioned in the claimed equation(s).

"Θ (0) provides an initial value which is non-zero but very sufficiently small value" needs to be defined since there is nothing in the specification, prosecution history, or the prior art to provide any indication as to what range of specific activity is covered by the term "Θ (0) is very sufficiently small value". Additionally, Θ (0) is not mentioned in the claimed equation(s).

The above are but a few specific examples of indefinite and functional or operational language used throughout the claims, and are only intended to illustrate the need for an extensive revision required to overcome all claim objections. The above-mentioned corrections therefore, are in no way a complete and thorough listing of every indefinite and functional or operational language used throughout the claims. Applicant is required to revise all of the claims completely, and not just correct the indefinite and functional or operational language mentioned above. The following art rejections are given in view of the above objections of claims, and therefore, the following art rejections are applied only as far as the claims are understood in view of the objections made in this Office action.

### *Claim Rejections - 35 USC § 103*

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1-3, 12-14, 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over prior art disclosed by applicant, **Torikai et al**. [hereinafter Torikai].

Torikai discloses a charge rate estimating apparatus for a secondary cell comprising: a current detecting section capable of measuring a current $I_t$ flowing through the secondary cell [see fig.2]; a terminal voltage detecting section capable of measuring a voltage across terminals of the secondary cell $V_t$ [see fig.2]; a parameter estimating section/Battery Mathematical Model [see fig.2] that calculates an adaptive digital filtering using a cell model in a continuous time series shown in an equation estimates all of parameters at one time. Torikai does not disclose the parameters corresponding to an open-circuit voltage which is an offset term of the equation (1) and coefficients of A(s), B(s), and C(s) which are transient terms; and a charge rate estimating section that estimates the charge rate from a relationship between a previously derived open-circuit voltage $V_0$ and the charge rate SOC using the open-circuit voltage $V_0 = B(s)/A(s) \times I + 1/C(s) \times V_0$, (1) wherein s denotes a Laplace transform operator, A(s), B(s), and C(s) denote poly-nominal functions of s. However, Torikai discloses a charge rate estimating apparatus by using an open circuit voltage detecting method [see page 996; fig.4 of the instant application] and using a polynomial equation (2) to estimate the battery SOC Θ. Torikai also discloses that determining the battery charge rate Θ is critical in environments where opportunities for recharging are limited, as well as the necessity of providing a user with accurate and reliable information, and that various approaches are currently used and known [see page1, column 1]. Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to combine all the variables involved in estimating the battery charge rate based on an OCV detecting method in one polynomial equation, as disclosed by Torikai, in order to define a particular process by performing routine derivations of very well known equations.

As to claims 2, 3, see remarks and reference above.

As to the method claims 12-14: the method steps will be met during the normal operation of the apparatus described above.

As to the method claim 16: Torikai discloses "storing the terminal voltage V(k)"/RAM, ROM [see page 1000] and denotes a parameter estimated value at a time point/every 0.1 sec and inputted in the system to estimate battery SOC Θ [see page 1000]. Therefore, it would have been obvious to a person

having ordinary skill in the art at the time the invention was made to combine all the variables involved in estimating the battery charge rate based on an OCV detecting method in one polynomial equation and use a time-based measurements, as disclosed by Torikai, in order to define a particular process by performing routine derivations of very well known equations.

As to the method claims 17-18, see remarks and reference above.

8. Claims 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over prior art disclosed by applicant, **Kozlowski et al**. [hereinafter Kozlowski].

Kozlowski discloses a charge rate estimating method for a secondary cell comprising measuring a current I(k) flowing through the secondary cell [see fig.2]; measuring a terminal voltage V(k) across the secondary cell [see fig.2];; storing the terminal voltage V(k) [see fig.1]; Kozlowski does not disclose specifically determining instantaneous current values $I_0(k)$, $I_1(k)$, and $I_3(k)$ and instantaneous terminal voltages $V_1(k)$, $V_2(k)$, and $V_3(k)$ from an equation (19), $I_0 = 1/G_1(s)\ I$, $I_1 = s/G_1(s)\ I$, $V_1 = s/G_1(s)\ V$, $I_2 = s^2/G_1(s)\ I$, $V\ 2 = s^2/G_1(s)\ V$, $I_3 = s^3/G_1(s)\ I$, $V_3 = s^3/G_1(s)\ V$, and $1/G_1(s) = 1/(p_1 s + 1)^3$, ( 19 ) wherein $p_1$ denotes a constant determining a responsive characteristic of $G_1(s)$; substituting the instantaneous current values $I_0(k)$, $I_1(k)$, and $I_3(k)$ and the instantaneous terminal voltages $V_1(k)$, $V_2(k)$, and $V_3(k)$ into an equation (18),

$$\gamma(k) = \lambda_3(k)/1 + \lambda_3(k)\,\omega^T(k)\,P(k-1)\,\omega(k)$$

$$\Theta(k) = \Theta(k-1) - \gamma(k)\,P(k-1)\,\omega(k)\,[\omega^T(k)\,\Theta(k-1) - y(k)]$$

$$P(k) = 1/\lambda_1(k)\,\{P(k-1) - \lambda_3(k)\,P(k-1)\,\omega(k)\,\omega^T(k)\,P(k-1)/1 + \lambda_3(k)\,\omega(k)\,\omega^T(k)\,P(k-1)\,\omega(k)\} = P'(k)\,\lambda_1(k)$$

$$\lambda_1(k) = \{\text{trace}\{P'(k)\}/\gamma_U : \lambda_1 <= \text{trace}\{P'(k)\}\,\gamma_U$$

$$\{\lambda_1 : \text{trace}\{P'(k)\}/\gamma_U <= \lambda_1 <= \text{trace}\{P'(k)\}/\gamma_L$$

$$\{\text{trace}\{P'(k)\}/\gamma_L : \text{trace}\{P'(k)\}/\gamma_L <= \lambda_1,$$

wherein $\Theta(k)$ denotes a parameter estimated value at a time point of k (k=0, 1, 2, 3 . . . ), $\lambda_1$, $\lambda_3$, $\gamma_U$ and $\gamma_L$ denote initial set value, $b<.\lambda_1<1$, $0<\lambda_3(k)<\infty$. $\Theta(0)$ provides an initial value which is non-zero, trace{P} means a trace of matrix P, etc.

However, Kozlowski discloses developing algorithms using no load/OCV voltage, terminal voltages at 10 sec, and each measurement is stored as an individual file [see pages 6-3151-3152]. With regard to the patent using temperature measurements for the battery: eliminating temperature measurements, cited in the Kozlowski reference, applicant neither extends the life of the batteries being charged, nor makes it easier to fully charge a battery, which is the object of his invention, as cited in the disclosure. Therefore it would be obvious to one skilled in the art at the time the invention was made that the elimination of an element and its function in a combination is an obvious expedient if the remaining elements perform the same functions as before. See ***Ex parte Wu***, 10 USPQ 2031 (Bd. Pat. App. & Inter. 1989), ***In re Larson,*** 340 F.2d 965, 144 USPQ 347 (CCPA 1965) and ***In re Kuhle,*** 526 F.2d 553, 188 USPQ 7 (CCPA 1975).

As to the instant application using a specific equation: the Prior Art also discloses that several models could be used [see fig.1]. Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to combine all the variables involved in estimating the battery charge rate based SOC on an OCV detecting method, as disclosed by Kozlowski, in order to define a particular process by performing routine derivations of very well known equations.

As to the method claims 17-18, see remarks and reference above.

9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

***Allowable Subject Matter***

10. Claims 4-11, 15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

With respect to claims 4, 15: none of the references of record prior to applicant's filing date discloses, teaches, or suggests a charge rate (SOC) estimating apparatus and method for a secondary cell comprising, *inter alia*, wherein the cell model is calculated from an equation (6) $V = K(T_2 s + 1)/ T_1 s + 1 \times I + 1/T_3 s + 1 \times V_0$ ,wherein K denotes an internal resistance of the secondary cell, $T_1$, $T_2$, and $T_3$ denote time constants, $1/G_1(s)$ denotes a low pass filter having a third order or more, and $1/G_2(s)$ denotes another low pass filter having a second order or more.

11. As allowable subject matter has been indicated, applicant's reply must either comply with all formal requirements or specifically traverse each requirement not complied with. See 37 CFR 1.111(b) and MPEP § 707.07(a).

***Conclusion***

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: **Tate et al**. [6927554] discloses an SOC estimator for a battery including a meter that generates a terminal voltage signal of the battery and a terminal current signal of the battery. A controller employs a linearized model of the battery and a time-varying state estimator. Fig. 3 is a graph of SOC based on open circuit voltage $V_o$. The prior art cited in PTO-892 and not mentioned above disclose related apparatus: **Arai et al**. [6850038] discloses a method and apparatus for estimating a SOC and OCV of a battery, and specifically Fig. 3B illustrates a characteristic/map of OCV for SOC.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Pia Tibbits whose telephone number is 571-272-2086. If unavailable, contact the Supervisory Patent Examiner Karl Easthom whose telephone number is 571-272-1989. The Technology Center Fax number is 571-273-8300.

14. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

PFT

December 1, 2005

Pia Tibbits

Primary Patent Examiner